

AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



for
UTILITIES SYSTEMS
(3E4X1)

MODULE 23
VALVES

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VALVES

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REVIEW ANSWER KEY Key-1

Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

OPR: HQ AFCESA/CEOT

Certified by: HQ AFCESA/CEO
(Colonel Lance C. Brendel)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

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UTILITIES SYSTEMS
(3E4X1)

INTRODUCTION

Before starting this AFQTP, refer to and read the “Trainee/Trainer Guide” located on the AFCESA Web site <http://www.afcesa.af.mil/>

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. *It is important for the trainer and trainee to understand* that an AFQTP does not replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core task:

AFQTP completion
Hands-on certification

Diamond task:

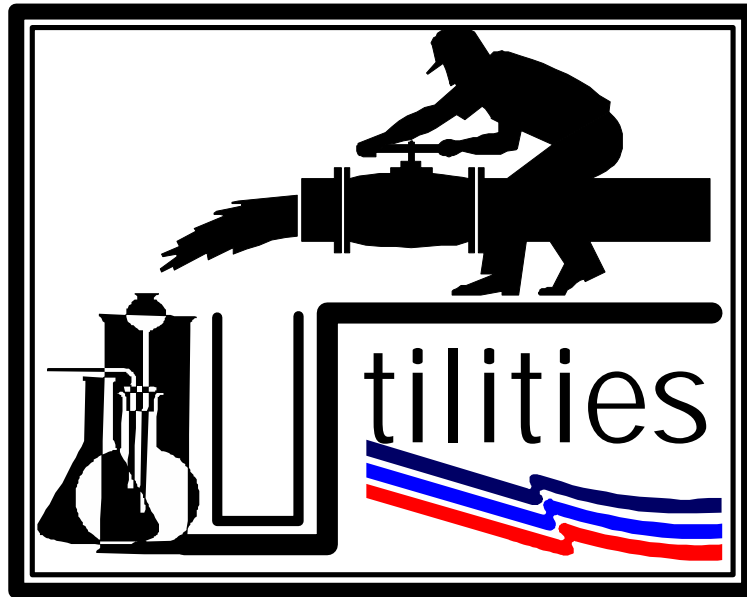
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOT revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

HQ AFCESA/CEOT
139 Barnes Dr. Suite 1
Tyndall AFB, FL 32403-5319
DSN: 523-6380, Comm: (850) 283-6380
Fax: DSN 523-6488
E-mail: ceott.helpdesk@tyndall.af.mil

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VALVES

MODULE 23

AFQTP UNIT 2

INSTALL VALVE BOXES (23.2.)

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INSTALL VALVE BOXES

Task Training Guide

STS Reference Number/Title:	23.2., Install Valve Boxes
Training References:	<ul style="list-style-type: none"> • CDC 3E451A • AFJMAN 32-1070 • Uniform Plumbing Code
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E4X1 AFSC.
Equipment/Tools Required:	<ul style="list-style-type: none"> • Valve box • Shovel • Bricks or stones
Learning Objective:	<ul style="list-style-type: none"> • Trainee will learn steps for install valve boxes properly.
Samples of Behavior:	<ul style="list-style-type: none"> • Trainee will be able to install valve boxes properly.
Notes:	
<ul style="list-style-type: none"> • Any safety violation is an automatic failure 	

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INSTALL VALVE BOXES

Background: Underground valves must have a means of access so that you can use your hand or a valve key to reach the operating nut or handle. This access is generally through a valve box. The valve box can be made from cast iron (the most common for water and gas valves), plastic, and cement. Exercise extreme care when installing the valve box over the valve and pipe. Never allow the weight of the valve box to rest on the pipe; instead let the soil around the pipe support the valve box. This can be accomplished by packing the earth and placing bricks or stones under the base of the valve box. This will prevent the box from settling and damaging the valve or piping. Valve boxes should always have a lid to prevent valve box from filling-up with debris. Some valve boxes have covers with locknuts to prevent unauthorized access. After installation, always update utility maps (as-builts) to reflect the change.

VALVE BOX INSTALLATION. (See Figure 1).

To perform task, follow these steps:

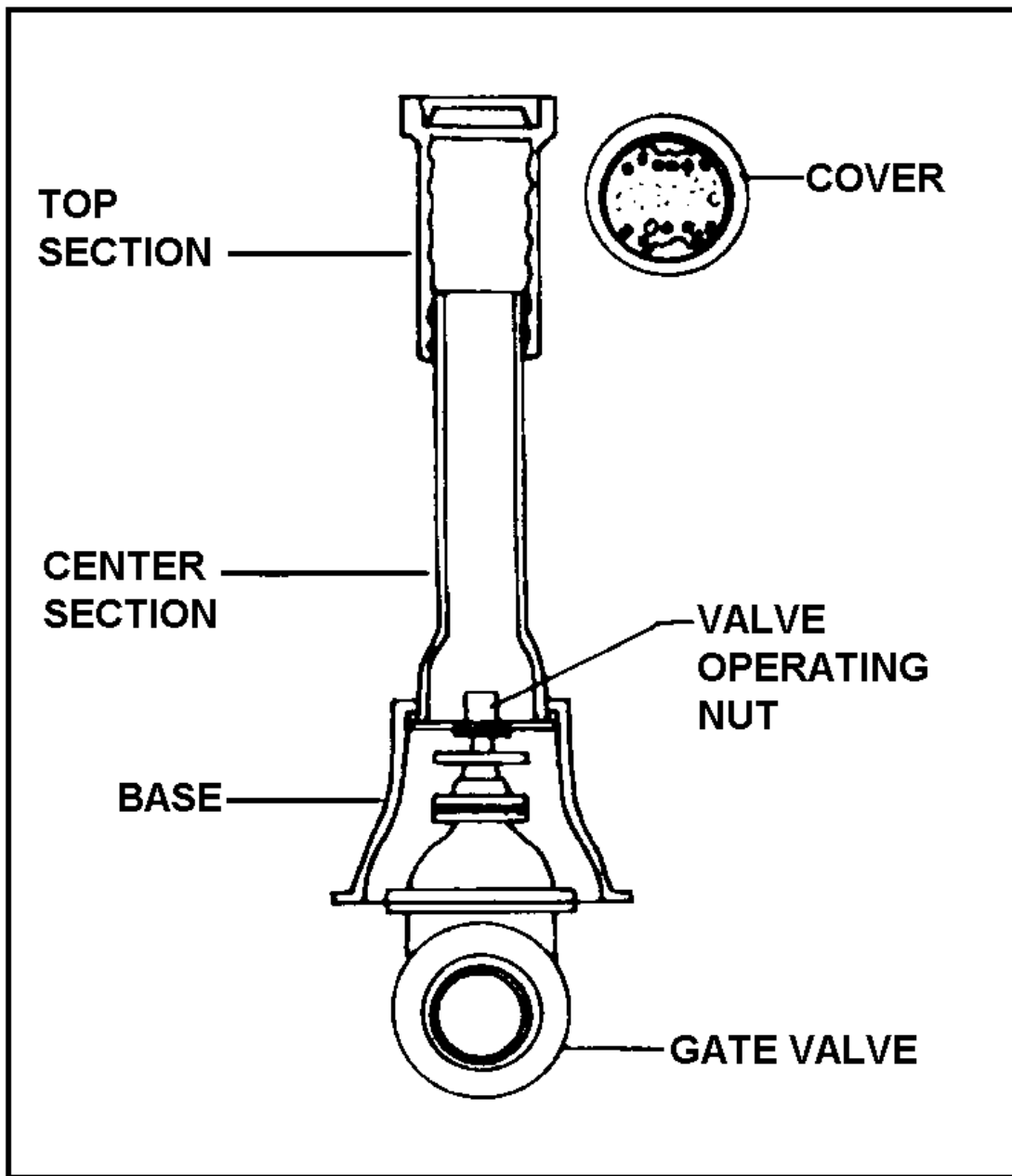
- Step 1:** Excavate around the valve where the valve box will be installed.
- Step 2:** Backfill around the valve, tamping soil as you backfill.
- Step 3:** Place bricks or flat stones around valve to create a solid base for the valve box.
- Step 4:** Set the base of the valve box over valve (see Hint).
- Step 5:** Backfill around base of valve box.
- Step 6:** Place top section onto the base. Screw down until the top section is at street or ground level, or tighten set screws depending on type of manufacturer.
- Step 7:** Backfill and tamp soil, this will ensure that the valve box remains straight.
- Step 8:** Place lid on valve box.
- Step 9:** Update utility maps.

HINT:

Do not rest the valve box on the valve or the piping. This will place undo stress on the piping system.

A solid base and a good job of backfilling will ensure that the valve box will stay in good alignment, and will keep settlement to minimum.

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Figure 1, Cross-Section of a Valve Box

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**Review Questions
for
Install Valve Boxes**

Question	Answer
1. The valve box should sit on top of the valve.	a. True b. False
2. Why are valve boxes important?	a. To support pipes b. To support valves c. To allow access to operation d. To allow access to pipes
3. How should the base of the valve box be supported?	a. On a solid base of compacted soil b. On a loose base of gravel c. With loose sand at the base d. With concrete at its base
4. The top of the valve box should be ½” below ground level.	a. True b. False

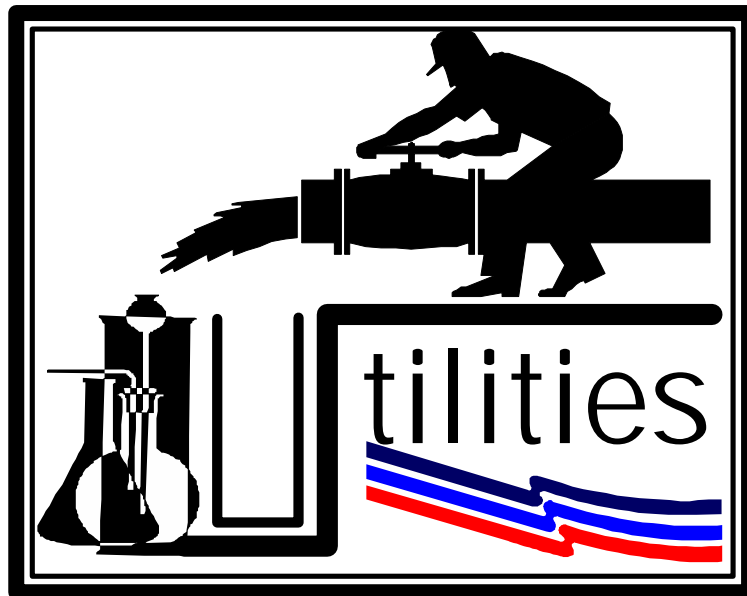
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INSTALL VALVE BOXES

Performance Checklist		
Step	Yes	No
1. Was equipment needs identified properly? <ul style="list-style-type: none"> Valve box Shovel Bricks or stones 		
2. Did the trainee complete step-by-step procedure for installing a valve box? <ul style="list-style-type: none"> Excavated around the valve where the valve box will be installed. Backfilled around the valve tamped soil as you backfill. Placed bricks or flat stones around valve to create a solid base for the valve box. Set the base of the valve box over valve. Backfilled around base of valve box. Placed top section onto the base Backfilled and tamped soil. Placed lid on valve box. Update utility maps. 		
3. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> Score 80% or higher. Did trainer review and explained all missed questions. 		
4. Did the trainee use sound safety practices?		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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REPLACE AND REPAIR VALVES

MODULE 23

AFQTP UNIT 4

PRESSURE RELIEF (23.4.1.)

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PRESSURE RELIEF

Task Training Guide

STS Reference Number/Title:	23.4.1., Pressure relief
Training References:	<ul style="list-style-type: none"> • CDC 3E451A • AFJMAN 32-1070 • Uniform Plumbing Code • Study Guide/Workbook J3ABR3E431 • Manufacturers Specifications
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E4X1 AFSC
Equipment/Tools Required:	<ul style="list-style-type: none"> • Standard Plumber's tool kit, Teflon tape, pipe dope, and pressure relief valve.
Learning Objective:	<ul style="list-style-type: none"> • Trainee will learn to repair by replacement a pressure relief valve
Samples of Behavior:	<ul style="list-style-type: none"> • Trainee will be able to replace a pressure relief valve
Notes:	
<ul style="list-style-type: none"> • Steps will be followed in sequence as needed • Any safety violation is an automatic failure 	

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PRESSURE RELIEF

Background: A pressure relief valve (PRV) is a safety device that automatically provides protection against excessive temperature, pressure, or both. It is designed to open to prevent storage tank from exploding. There are several types of pressure relief valves and places where they are installed: Hot water tanks, pressure filters, holding tanks, and boilers just to name a few. The most common type you will work with is the temperature and pressure (T&P) valve used on water heaters. It must be installed in the approved location according to the manufacturer's instruction. It must also have a drain line that extends outside the building, that is no more than 24-inches high and no less than six inches of the ground. A PRV must never have a valve located between it and the tank.

NOTE:

This would be a good time to read the manufacturer's instruction, especially before you replace the existing PRV.

REPLACE/REPAIR PRVs.

To perform this task, follow these steps:

Step 1: Turn gas control knob to "OFF" position and close the gas shutoff valve.

NOTE:

For an electric water heater, shut off power at the main breaker box. Make sure you lock and tag out.

Step 2: Close the cold water supply valve.

Step 3: Before removing T&P valve drain 1 gal of water from tank if the valve is located on top of tank. If the T&P valve is installed on the side of the tank you will have to drain and 4 to 5 gals of water.

Step 4: Loosen and remove drain pipe, which may be threaded directly to the T&P valve or to an adapter.

Step 5: Fit a smooth jaw wrench over the old relief valve and turn counterclockwise to unscrew the valve from the tank.

NOTE:

If you have an old tank, the valve may be difficult to remove. Use firm, steady pressure (have a helper brace the tank if necessary), but do not jerk the valve or the tank may be damaged.

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Step 6: Apply Teflon tape to the threads of the new T&P valve and screw it into the tank by hand; then tighten with a smooth jaw wrench.

Step 7: Screw the drain pipe back into the valve outlet.

Step 8: Open the cold water supply valve to refill water heater tank.

Step 9: Open gas shutoff and re-light heater (gas type), or turn the electricity back on.

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**Review Questions
for
Pressure Relief**

Question	Answer
1. Where is a pressure relief valve most commonly used?	a. On hot water tanks b. On distribution mains c. On water closets d. On lavatories
2. What is a pressure relief valve designed to do?	a. Keep tanks from imploding b. Keeps tanks from rupturing c. Keep tanks from freezing d. Keep tanks cool
3. Where must the drain be piped to?	a. The basement b. The roof c. The outside d. The storm drain
4. If the valve is located on top of the water tank how many gallons should you drain from tank?	a. One gallon b. Two gallons c. Three gallons d. Four gallons
5. Why should you never jerk on the valve when unscrewing it from the tank?	a. The handle may break b. The threads may be marred c. The tank may be damaged d. None of the above
6. What is the maximum height of a drain?	a. 1 foot b. 2 feet. c. 3 feet d. 4 feet

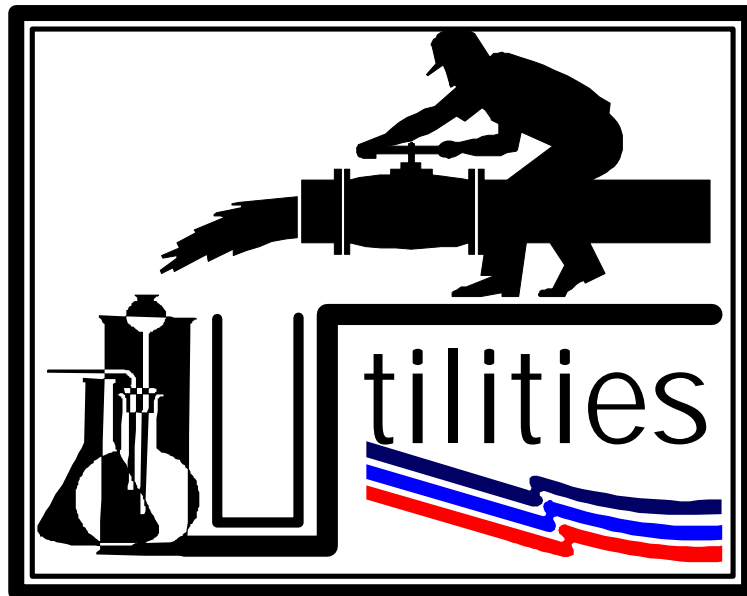
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PRESSURE RELIEF

Performance Checklist		
Step	Yes	No
1. Did trainee identify all the equipment needed for the job? <ul style="list-style-type: none"> • Plumber's standard tool kit • Teflon tape • Pipe dope • Pressure relief valve. 		
2. Did the trainee take proper steps installing new T&P valve? <ul style="list-style-type: none"> • Turned gas control knob to "OFF" position and close the gas shutoff valve or shut off power at the main breaker box. • Closed the cold water supply valve. • Removed T&P valve after draining 1 gal of water if valve is located on top of tank or 4 to 5 gals if installed on side of tank. • Removed drain pipe. • Used a smooth jaw wrench to unscrew T&P valve. • Applied Teflon tape to the threads and screwed valve into the tank by hand; then tightened with a smooth jaw wrench. • Screwed drain pipe back into the valve outlet. • Opened the cold water supply valve to fill water heater tank. • Opened gas shutoff and re-light heater (gas type), or turn the electricity back on 		
3. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> • Score 80% or higher. • Did trainer review and explained all missed questions. 		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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REPLACE AND REPAIR VALVES

MODULE 23

AFQTP UNIT 4

CHECK (23.4.3.)

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CHECK

Task Training Guide

STS Reference Number/Title:	23.4.3., Check
Training References:	<ul style="list-style-type: none"> • TPC Training Systems Lesson Seven (Common Valves) • CDC 3E451A • AFJMAN 32-1070 • Uniform Plumbing Code
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E4X1 AFSC.
Equipment/Tools Required:	<ul style="list-style-type: none"> • Standard Plumbers Tool Box
Learning Objective:	<ul style="list-style-type: none"> • Trainee will learn to repair a check valve, basic operation, and uses.
Samples of Behavior:	<ul style="list-style-type: none"> • Trainee will be able repair, explain the basic uses, and operations of a check valve.
Notes:	
<ul style="list-style-type: none"> • Steps will be followed in sequence as needed • Any safety violation is an automatic failure 	

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CHECK

Background: Check valves allow the flow of liquids in one direction only when the flow is moving in the proper direction, the valve remains open. When the flow stops or reverses the valve closes automatically from the fluid pressure against it. There are five types of check valves for the use of directional flow: The swing check, horizontal-lift check (See Figure 1), vertical-lift check, ball check and foot valve. Repairs and replacement on these valves are relatively similar. You will have to remove a bonnet, inspect, clean and/or replace the worn parts if needed. Check valves should be installed with isolation valves on the upstream and downstream sides of the device. When working with valves 2 inches or less it is more economical to replace the valve.

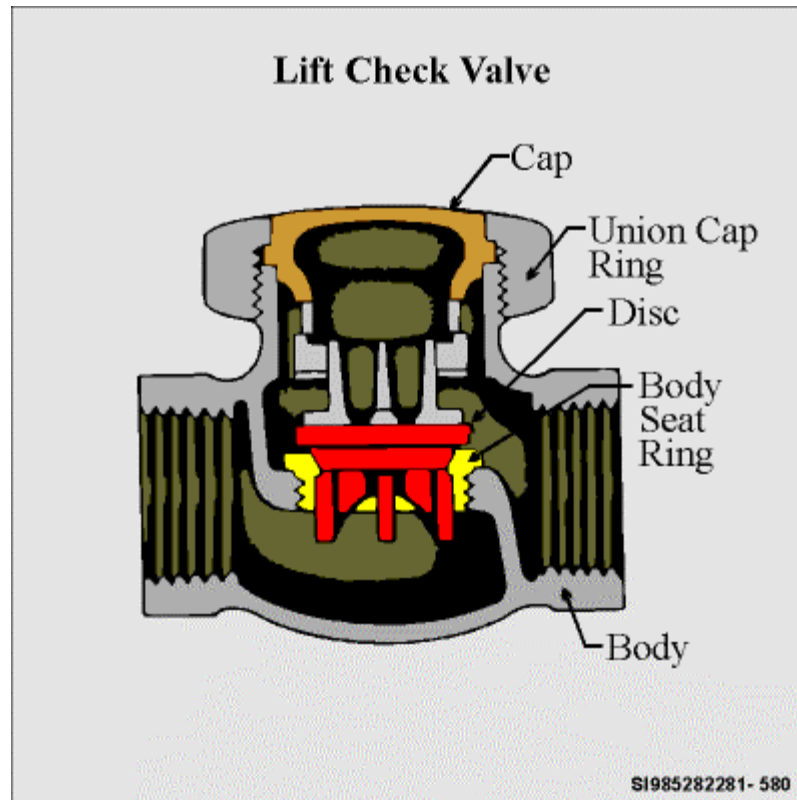


Figure 1, Lift Check

NOTE:

It may not be cost effective to repair some sizes. Replacement often saves time and money.

REPAIRING A SWING CHECK VALVE. (See Figure 2).

To perform this task, follow these steps:

Step 1: Isolate valve from rest of the system.

Step 2: Remove the cap using a smooth jaw wrench.

- Using a pipe wrench may damage the valve.
- Some check valves may require the removal of cap nuts to remove the cap.

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Step 3: Remove the disc.

Step 4: Inspect and clean all parts replace if needed.

Step 5: Inspect the seat.

Step 6: Remove and replace the seat.

NOTE:

If the seat cannot be replaced, you may have to use a reface the seat using a reseating tool or Emory cloth.

Step 7: Assemble check valve in reverse order.

Step 8: Put valve back in operation.

REPLACING A SWING CHECK VALVE.

To perform this task, follow these steps

Step 1: Determine the method of replacement you will need to use to replace the valve.

- Is there an in-line union that you can disconnect, or will you have to use a pipe cutter?
- What material is valve installed on?

Step 2: Isolate valve from system.

Step 3: Remove valve by means you determined (i.e. cut it out, or disconnect the union).

NOTE:

When replacing valves 3 inches or larger flanged connections may be used instead of threaded connections. Disassembling of flanged joints is a little more time consuming but the process is basically the same.

Step 4: Replace valve. Consider installing a union if one was not already there (this will make it easier to replace the valve if it ever fails again).

NOTE:

When installing check valves with flanged connections ensure you have a gasket installed to seal the connection.

Step 5: Put valve back into service by turning the water system on. Check valve operation.

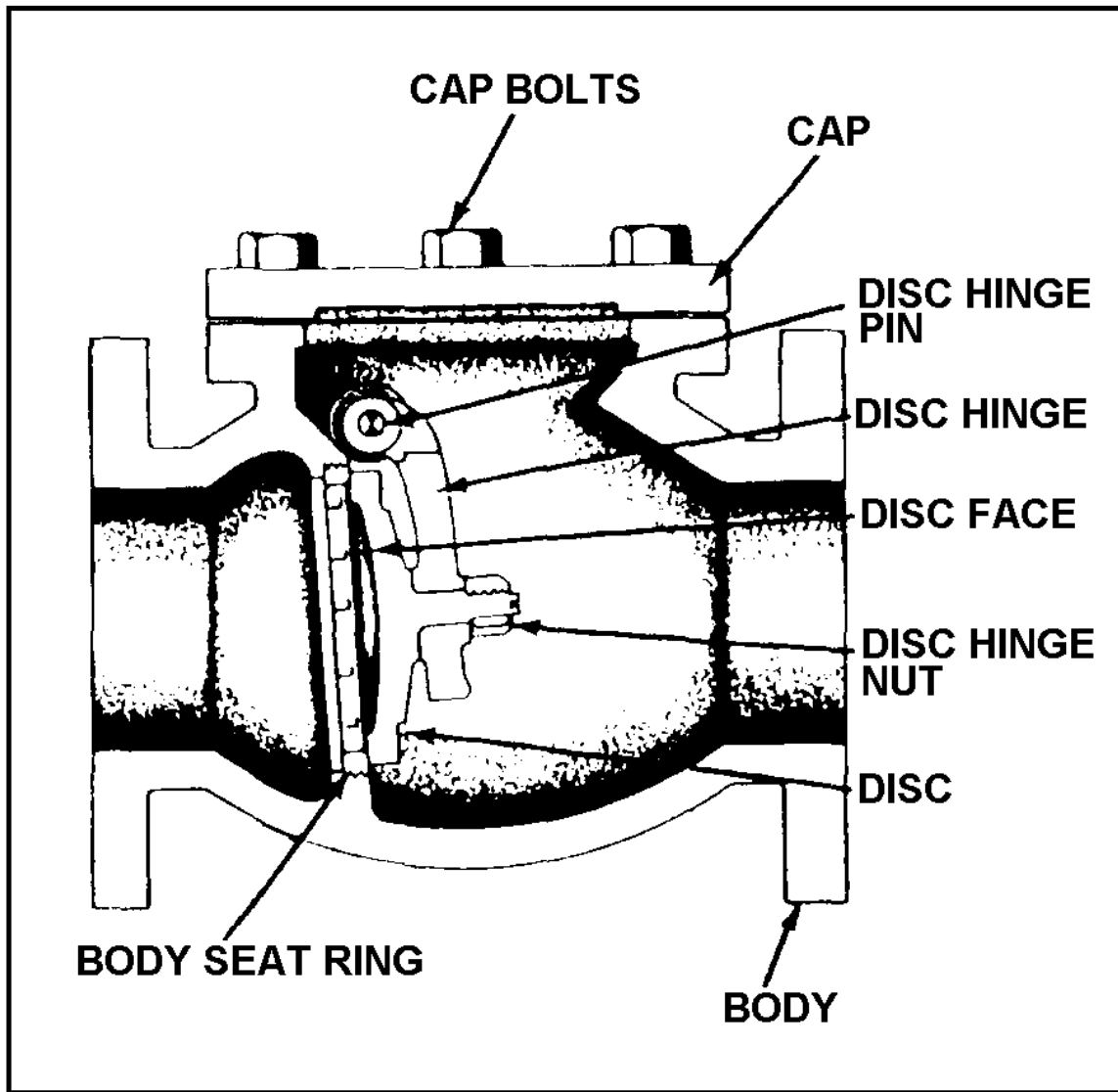


Figure 2, Swing Check Valve

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**Review Questions
for
Check**

Question	Answer
1. What is the purpose of a check valve?	a. Stop the flow of water b. Start the flow of water c. Direct the flow of water d. Allows flow of liquids in one direction only.
2. What tool do you use to remove the cap?	a. Smooth-jaw wrench b. Soft-jaw wrench c. Slip-joint pliers d. None of the above
3. Why should you never use a pipe wrench when removing the cap?	a. It will damage the wrench b. You may damage the valve c. It may over-tighten the valve d. All of the above
4. If the seat is worn and cannot be removed what should you do?	a. Reface it using Emory cloth. b. Re-seat it using a screwdriver c. Re-seat is using a cold chisel d. Re-seat is using a ball peen hammer

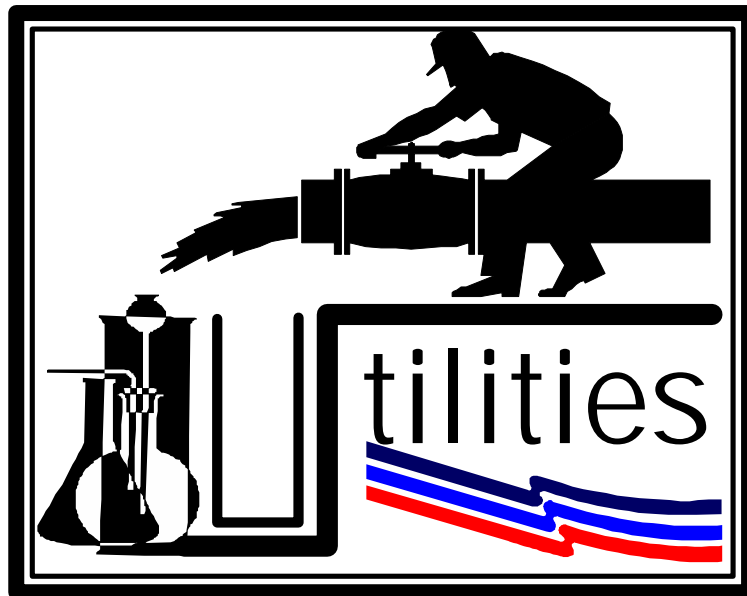
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CHECK

Performance Checklist		
Step	Yes	No
1. Did trainee identify all the equipment needed for the job?		
2. Did the trainee take proper safety precautions?		
3. Did the trainee take the proper steps to repair a check valve? <ul style="list-style-type: none"> • Isolate valve from rest of the system • Remove the cap • Remove the disc • Inspect and clean all parts replace if needed • Inspect the seat • Remove and replace the seat • Test for leaks • Put valve back in operation 		
4. Did the trainee take the proper steps in replacing a check valve? <ul style="list-style-type: none"> • Isolate the check valve • Remove the valve from the piping system it serves • Apply Teflon tape to pipe for threaded connection • Install new valve • Test for leaks • Clean up the area 		
5. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> • Score 80% or higher. • Did trainer review and explained all missed questions? 		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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REPLACE AND REPAIR VALVES

MODULE 23

AFQTP UNIT 4

GLOBE (23.4.4.)

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GLOBE

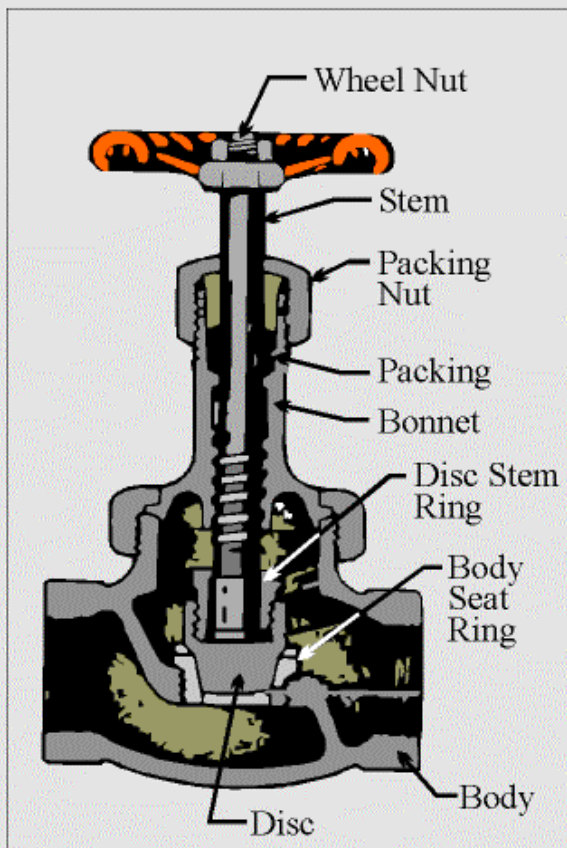
Task Training Guide

STS Reference Number/Title:	23.4.4., Globe
Training References:	<ul style="list-style-type: none"> • CDC 3E451A • AFJMAN 32-1070 • Uniform Plumbing Code • Study Guide/Workbook J3ABR3E431
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E4X1 AFSC.
Equipment/Tools Required:	<ul style="list-style-type: none"> • Basic plumbers tool box
Learning Objective:	<ul style="list-style-type: none"> • Trainee will learn to repair and replace globe valves.
Samples of Behavior:	<ul style="list-style-type: none"> • Trainee will be able to repair and replace globe valves including checking for proper operation.
Notes:	
<ul style="list-style-type: none"> • Steps will be followed in sequence as needed • Any safety violation is an automatic failure 	

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GLOBE

Background: Globe valves are used for services requiring frequent operation and where the valve may be used to regulate or throttle flow. These are benefits a globe valve has over a gate valve. Globe valves can be installed using threaded, soldered, flanged, or welded joints. Globe valves like check valves must be installed in the direction of flow as indicated by an arrow stamped on the valve body. Typical problems, which occur with globe valves, are water leaking around the stem at the packing nut and a bad seat or bad disc which is indicated by water leaking by when the valve is shut. See Figure 1, Globe Valve.



Plug Disc

- Consists of a tapered plug that provides a wide area of seating contact.
- Superior to all others for severe throttling service.
- Most effective in resisting erosive effects of close throttling.

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Figure 1, Globe Valve

NOTE:

In some cases it may be easier and more cost effective to replace the valve altogether.

REPLACE/REPAIR GLOBE VALVES.

To perform this task, follow these steps:

Step 1: Isolate globe valve from the rest of the system.

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NOTE:

If water is leaking around the stem at the packing nut tighten the packing nut. If that does not remedy the problem it may be necessary to remove and replace the packing.

Step 2: Using smooth-jawed wrench, remove the bonnet.

Step 3: Remove the stem from the bonnet.

- Place the disc in a vise and unscrew the disc stem ring.

Step 4: Replace the stem and tighten the disc stem ring.

NOTE:

In some valves, a pin is inserted in a hole to lock the disc on the stem. This procedure holds the disc in place on the stem while you are lapping the valve.

Step 5: Apply a small amount of grinding compound to both the disc and the seat.

- Do not use grinding compound liberally as it could remove too much of the metal.

Step 6: Place the disc down onto the valve seat and the bonnet nut back on as if you were going to reassemble the valve.

- Do not tighten the bonnet nut, as it is only acting as a guide during the grinding process.

Step 7: Keeping a firm hold on the handle, oscillate (twist) it back and forth, stopping from time to time to check the seat and disc. Remember not to grind more than necessary.

Step 8: Wipe the disc, seat, and body clean of all compound and dirt.

NOTE:

Some seat rings are removable. Use an unseating tool to remove the seat ring. If the valve has a composition disc you can just replace the disc.

Step 9: Reassemble the valve in reverse order.

Step 10: Test for leaks.

Step 11: Put valve back into operation.

REPLACING A GLOBE VALVE.

To perform this task, follow these steps

Step 1: Determine the method of replacement you will need to use to replace the valve.

- Is there an in-line union that you can disconnect, or will you have to use a pipe cutter?
- What material is valve installed on?

Step 2: Isolate valve from system.

Step 3: Remove valve by means you determined (i.e. cut it out, or disconnect the union).

NOTE:

When replacing valves 3 inches or larger flanged connections may be used instead of threaded connections. Disassembling of flanged joints is a little more time consuming but the process is basically the same.

Step 4: Replace valve. Consider installing a union if one was not already there (this will make it easier to replace the valve if it ever fails again).

NOTE:

When installing Globe valves with flanged connections ensure you have a gasket installed to seal the connection.

Step 5: Put valve back into service by turning the water system on. Check valve operation.

Review Questions for Globe

Question	Answer
1. What benefit does a globe valve have over a gate valve?	<ul style="list-style-type: none"> a. Can be used to regulate or throttle flow b. Adjusted with more turns c. Much more secure restriction d. Smoother flow through the valve
2. What kind of tool is used to remove the bonnet of a globe valve?	<ul style="list-style-type: none"> a. Slip-joint pliers b. Soft-jaw wrench c. Smooth-jaw wrench d. None of the above
3. What is used to re-surface the disc and seat?	<ul style="list-style-type: none"> a. Rasp file b. Fine file c. Soft bristle wire brush d. Grinding compound
4. What may happen if you use an excessive amount of emery-based compound to resurface disc and seat?	<ul style="list-style-type: none"> a. It will not be effective metal b. You may remove too much material c. Works best with small amounts on a file d. Emery compound is not used
5. If the seat cannot be repaired what corrective action should be taken.	<ul style="list-style-type: none"> a. Replace the entire seat b. Replace the entire valve c. Replace the entire system d. Call the manufacturer

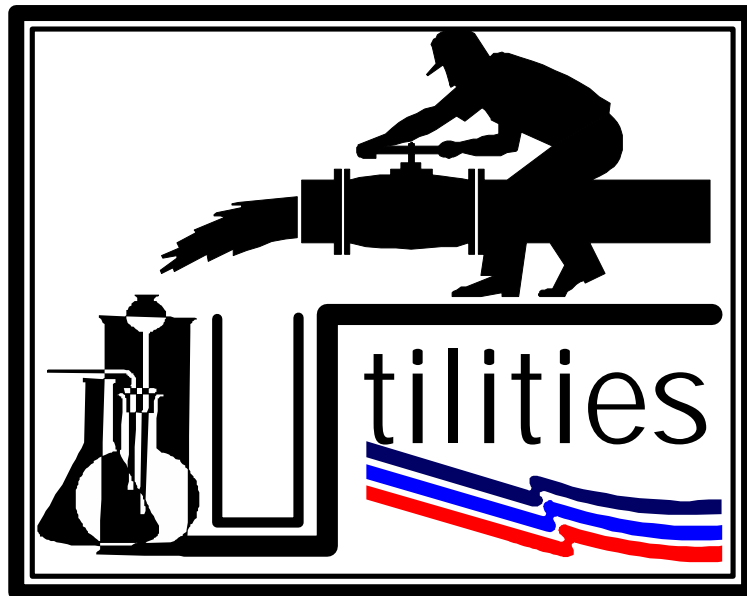
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GLOBE

Performance Checklist		
Step	Yes	No
1. Did trainee identify all the equipment needed for the job?		
2. Did the trainee take proper safety precautions?		
3. Did the trainee take the proper steps to repair a globe valve? <ul style="list-style-type: none"> • Isolate globe valve from the rest of the system • Remove the bonnet • Remove the stem from the bonnet • Replace the stem and tighten the disc stem • Apply a small amount of grinding compound • Place the disc down onto the valve seat • Keeping a firm hold on the handle, oscillate (twist) it back and forth • Wipe the disc, seat, and body clean of all compound and dirt • Reassemble the valve in reverse order • Test for leaks • Put valve back into operation 		
4. Did the trainee take the proper steps to replace a globe valve? <ul style="list-style-type: none"> • Isolate the Globe valve Use a pipe wrench to remove the valve from the piping system it serves • Use a pipe wrench to remove the valve from the piping system it serves • Apply Teflon tape to pipe for threaded connection • Install new valve • Test for leaks • Clean up the area 		
5. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> • Score 80% or higher. • Did trainer review and explained all missed questions? 		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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REPLACE AND REPAIR VALVES

MODULE 23

AFQTP UNIT 4

GATE (23.4.5.)

Notice. This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

GATE

Task Training Guide

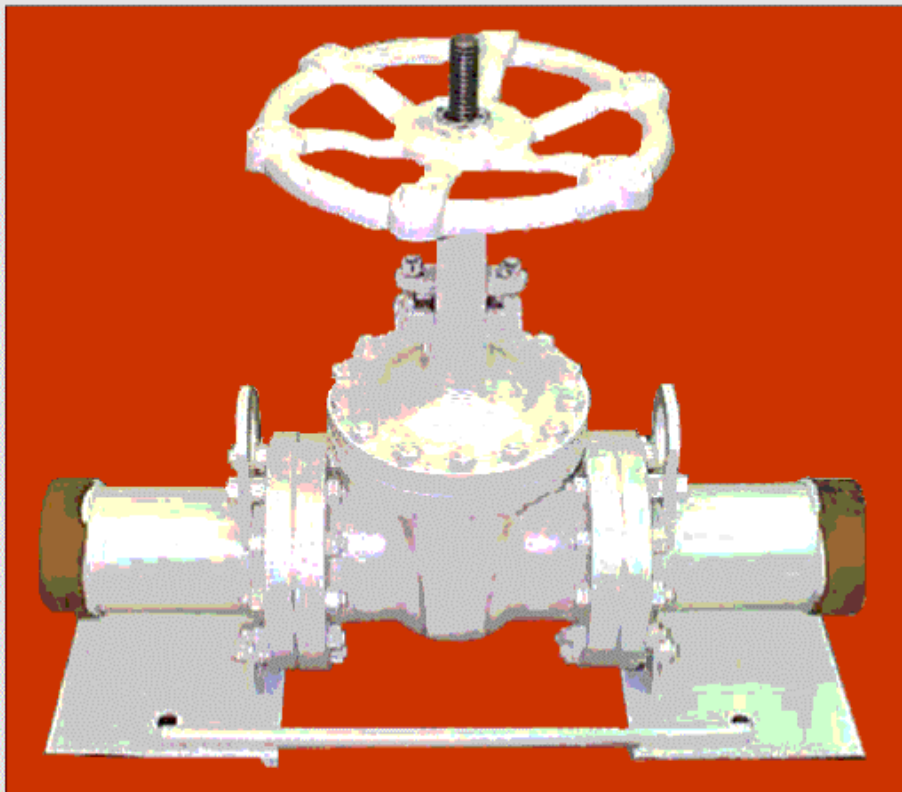
STS Reference Number/Title:	23.4.5., Gate
Training References:	<ul style="list-style-type: none"> • CDC 3E451A • AFJMAN 32-1070 • Uniform Plumbing Code • Study Guide/Workbook J3ABR3E431
Prerequisites:	<ul style="list-style-type: none"> • Possess as a minimum a 3E4X1 AFSC.
Equipment/Tools Required:	<ul style="list-style-type: none"> • Basic plumbers tool box
Learning Objective:	<ul style="list-style-type: none"> • Trainee will learn to repair and replace gate valves.
Samples of Behavior:	<ul style="list-style-type: none"> • Trainee will be able to repair and replace gate valves to include checking proper operation.
Notes:	
<ul style="list-style-type: none"> • Steps will be followed in sequence as needed • Any safety violation is an automatic failure 	

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GATE

Background: Gate valves are used primarily for start/stop service. They are not designed to regulate or throttle flow therefore they should be in one of two positions fully open or fully closed. There are two kinds of gate valves, rising stem (**See Figure 1, Rising Stem**) and non-rising stem. Rising stem gate valves are commonly found in valve pits or pump rooms, and are operated by turning a wheel valve handle to open and close it. A threaded stem will rise (open) and retract (close) with operation of the valve wheel. Non-rising stem gate valves are usually found underground. It is operated by placing a valve key over a two inch square operating nut. Access to the operating nut is gained through a valve box. Gate valves should be operated at least biannually to prevent them from seizing or becoming stiff when opening or closing. A stuffing box holds graphite packing that seals the bonnet and prevents leaks around the stem. A packing nut is used to apply pressure to the packing gland. Most leaks around the stem or stuffing box can be taken care of by tightening the packing nut. If that doesn't work, removal and replacement of the packing may be your next option.

Gate Valve With Rising Stem



S198 5282342-400

Figure 1, Rising Stem

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NOTE:

Always tighten the nuts down evenly (criss-cross) on a bolted gland. Uneven tightening may bind the stem.

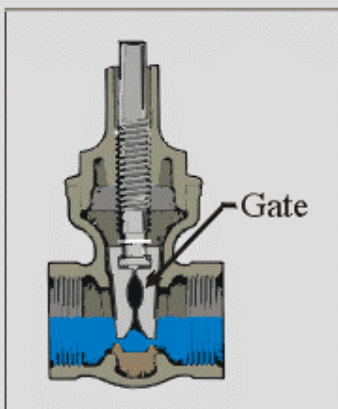
HINT:

Valve stems may be out of alignment or broken, or the threads may be stripped. The disc and seats may be worn to the point that they cannot be resurfaced. You may also give thought to the time and cost required to make repairs. If this is the case, you will have to replace the entire valve.

In the event you have to replace the valve these actions can be taken. Most replacements can be done using the same principles with the understanding in mind that the location, size of the valve, material used in the installation, and the method you will be using may be different.

(See Figure 2, Components of a Gate Valve.)

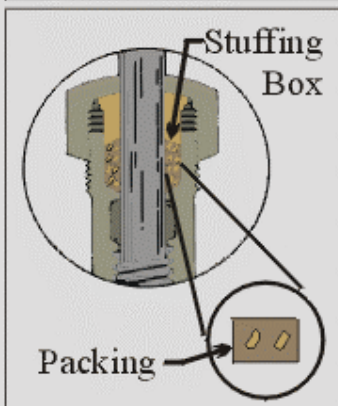
Inspection of Gate Valves Consist of Valve Seat and Valve Stem



- Foreign matter prevents proper seating on gate valves

— To remedy:

1. Leave valve closed for a few minutes
2. Raise or open gate an inch or so
3. Water flowing across seat should clear accumulation
4. If you cannot get a tight closure, open nearest downstream fire hydrant to increase the velocity across the seat



- Modern gate valves use O-rings as a seal
- You are likely to encounter valves with graphite packing in the stuffing box
 - Packing seals the bonnet against leaks around the stem

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Figure 2, Components of a Gate Valve

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REPLACING GATE VALVES.

To perform this task, follow these steps:

Step 1: Determine the method of replacement you will need to use to replace the valve.

- Is there an in-line union that you can disconnect, or will you have to use a pipe cutter?
- What material is valve installed on?

Step 2: Isolate valve from system.

Step 3: Remove valve by means you determined (i.e. cut it out, or disconnect the union).

NOTE:

When replacing valves 3 inches or larger flanged connections may be used instead of threaded connections. Disassembling of flanged joints is a little more time consuming but the process is basically the same.

Step 4: Replace valve.

- Consider installing a union if one was not already there (this will make it easier to replace the valve if it ever fails again).

NOTE:

When installing check valves with flanged connections ensure you have a gasket installed to seal the connection.

Step 5: Put valve back into service by turning the water system on. Check valve operation.

REPAIRING GATE VALVES. If repairs to gate valves can be made, the following instructions will assist the trainee. This is only a guideline, the procedures you use may vary.

To perform this task, follow these steps:

Step 1: Isolate valve from system.

NOTE:

If water is leaking around the stem at the packing nut tighten the packing nut. If that does not remedy the problem it may be necessary to remove and replace the packing. (See Figure3)

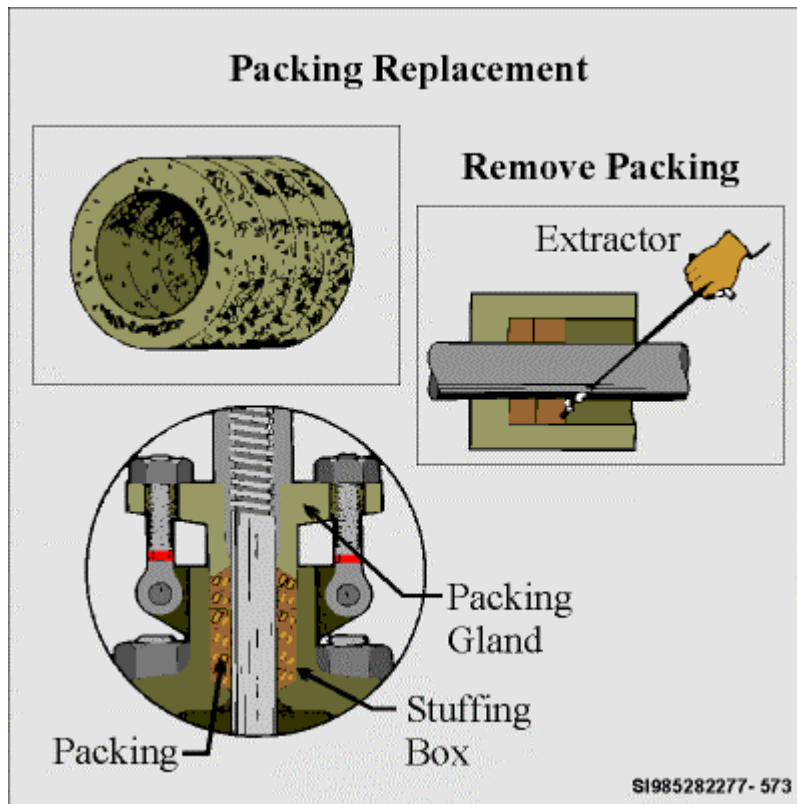


Figure 3, Packing Replacement

Step 2: Remove bonnet using a smooth-jawed wrench to prevent damage to the valve.

Step 3: Clean and examine the disc, valve body, and seat.

Step 4: Remove all corrosion, discard all old gaskets, and if required, resurface the discs and seats.

Step 5: Apply Prussian Blue to the surface of the disc and drop the disc into the body to check for nicks or scratches in the disc or seat.

Step 6: Repair nicks or scratches in the disc or seat with Emory cloth.

Step 7: Once you have obtained a good seal between the disc and seat the valve is ready to be reassembled.

Step 8: Insert the stem into the bonnet.

Step 9: Assemble other parts, attach the disc to the stem, and place the entire assembly into the valve body.

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HINT:

Raise the disc to prevent contact with the seats, so the bonnet can be seated properly on the body before tightening the joint.

Step 10: Test the valve to make sure the repairs have been made properly.

Step 11: Put valve back into service.

Figure 3, Solid Wedge Disc Gate Valve

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Review Questions for Gate

Question	Answer
1. What are gate valves primarily used for?	<ul style="list-style-type: none"> a. Throttling b. Start/stop service c. Pressure relief d. All of the above
2. What two kinds of gate valves do we use on many Air Force installations?	<ul style="list-style-type: none"> a. Visible and non-visible discs b. Holding and non-holding c. Rising and non-rising stems d. Throttling and non-throttling
3. Where are rising stems commonly found?	<ul style="list-style-type: none"> a. Only pump houses b. Valve boxes and street mains c. Valve pits and pump houses d. There are no such valves
4. How often should you perform preventive maintenance?	<ul style="list-style-type: none"> a. Annually b. Semi-annually c. Quarterly d. Monthly
5. What do you apply to the surface of the disc when checking for contact with the seat?	<ul style="list-style-type: none"> a. Regal Red b. Russian Red c. Prussian Purple d. Prussian Blue
6. Why must you raise the disc before tightening the bonnet to the valve body?	<ul style="list-style-type: none"> a. Ensure proper seating of the bonnet b. It will not work any other way c. To lock the disc against the seat d. To prevent vibrations in the valve housing

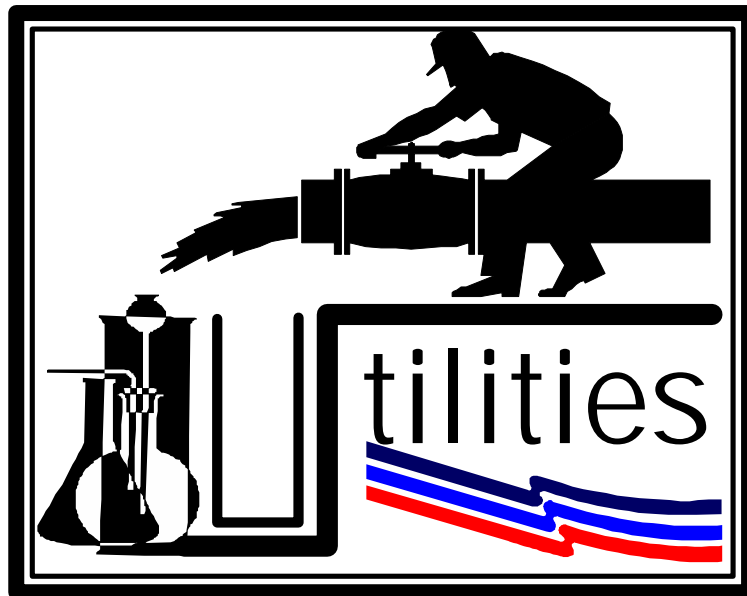
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GATE

Performance Checklist		
Step	Yes	No
1. Did trainee identify all the equipment needed for the job?		
2. Did the trainee take proper safety precautions?		
3. Did the trainee take the proper steps in replacing a gate valve? <ul style="list-style-type: none"> • Determine the method of replacement • Isolate valve from system • Remove valve • Replace valve • Put valve back into service 		
4. Did the trainee take the proper steps to repair a gate valve? <ul style="list-style-type: none"> • Isolate valve from system • Remove bonnet • Clean and examine the disc, valve body, and seat • Remove all corrosion • Apply Prussian Blue to the surface of the disc • Repair nicks or scratches • Insert the stem into the bonnet • Assemble other parts, attach the disc to the stem, and place the entire assembly into the valve body. • Test the valve to make sure the repairs have been made properly • Put valve back into service 		
5. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> • Score 80% or higher. • Did trainer review and explained all missed questions? 		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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REPLACE AND REPAIR VALVES

MODULE 23

AFQTP UNIT 4

BALL (23.4.6.)

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BALL

Task Training Guide

STS Reference Number/Title:	23.4.6., Ball
Training References:	<ul style="list-style-type: none">• CDC 3E451A• AFJMAN 32-1070• Uniform Plumbing Code• Study Guide/Workbook J3ABR3E431
Prerequisites:	<ul style="list-style-type: none">• Possess as a minimum a 3E4X1 AFSC.
Equipment/Tools Required:	<ul style="list-style-type: none">• Basic plumbers tool box
Learning Objective:	<ul style="list-style-type: none">• Trainee will learn to replace a ball valve
Samples of Behavior:	<ul style="list-style-type: none">• Trainee will be able to replace a ball valve
Notes:	
<ul style="list-style-type: none">• Steps will be followed in sequence as needed• Any safety violation is an automatic failure	

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BALL

Background: Ball valves are quick opening/closing devices. The basic components of a ball valve are the handle, a stem, a disc (ball), and seats, which are machined into the valve body. The ball has a hole through it. When the valve handle is in line (parallel) with the pipe it is servicing, the valve is open. When the valve handle is across (perpendicular) with the pipe it is servicing, the valve is closed. In addition to rapid opening and closing, the advantage of this valve is that line pressure helps keep it closed, and when open fluid can flow through in either direction. It also provides years of service without major maintenance. The maintenance you would perform would be to exercise (operate), and lubricate all parts of seating and rotating mechanisms. See Figure 1.

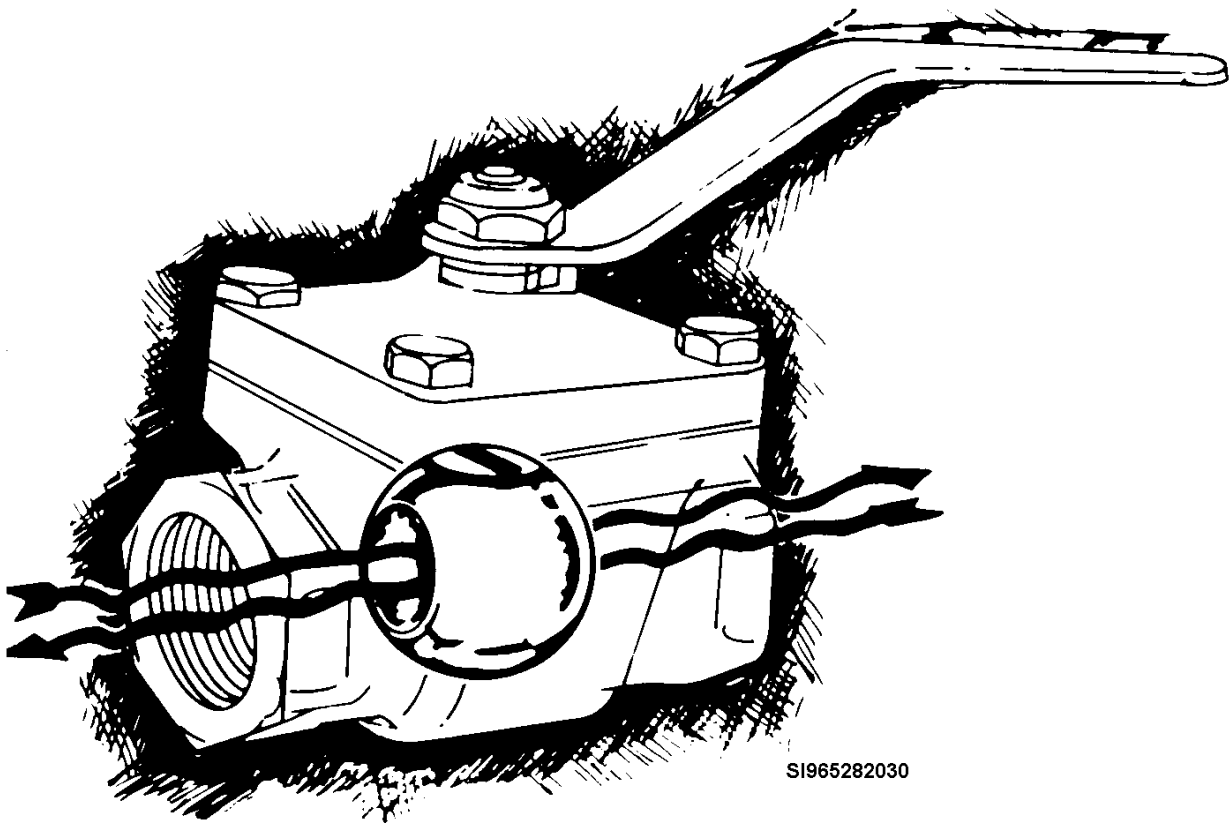


Figure 1, Ball Valve

NOTE:

You will not repair this type of valve, because it is easier and more cost effective to replace it with a new one.

REPLACE BALL VALVES. In the event a ball valve fails, the following steps will assist the trainee with its replacement. (See Figure 1).

To perform this task, follow these steps:

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Step 1: Isolate valve from rest of system.

Step 2: Determine if there is an in-line union, or if you will have to cut pipe to remove valve from system.

Step 3: If a union is in-line take it loose using pipe wrenches, you may have to use a back-up wrench on line side of union.

Step 4: Unscrew nipple from valve.

Step 5: Unscrew bad valve from opposite side of valve.

Step 6: Apply Teflon tape or pipe dope to threads of pipe.

Step 7: Screw valve onto pipe, use pipe wrench to tighten.

Step 8: Apply Teflon tape or pipe dope to the threads of the opposite end of nipple that has the union on it.

Step 9: Screw nipple into valve and tighten with a pipe wrench.

- A back-up wrench may be needed to hold valve in place.

Step 10: Connect union and tighten using a pipe wrench.

- A back-up wrench may be needed to keep pipe from turning.

Step 11: Check operation of valve.

Step 12: Turn water supply back on and check for leaks.

NOTE:

If there is not an in-line union you may have to apply different methods. In any event, make sure you install a union while making your replacement.

Review Questions for Ball

Question	Answer
1. What does the ball in a ball valve seal against to prevent the flow of liquid?	<ul style="list-style-type: none"> a. One seat rings b. Two seat rings. c. Three seat rings d. Spherical seat rings
2. What repairs are made on ball valves and why?	<ul style="list-style-type: none"> a. Resurfacing the ball b. Resurfacing the spherical seat c. Aligning the handle with the cylindrical hole d. None. It is easier and more cost effective to replace
3. The method of replacement is determined by the existence of an in-line union.	<ul style="list-style-type: none"> a. True b. False
4. What should you apply to the threads of the pipe when replacing a ball valve?	<ul style="list-style-type: none"> a. Epoxy b. PVC cement c. Teflon tape, or pipe dope d. Nothing. It's self sealing
5. If you have to cut the pipe to replace a valve, what should you install with new valve?	<ul style="list-style-type: none"> a. A flange b. An elbow c. A union. d. A tee

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BALL

Performance Checklist		
Step	Yes	No
1. Did trainee identify all the equipment needed for the job?		
2. Did the trainee follow proper safety precautions?		
3. Did the trainee follow the proper steps for replacing a ball valve? <ul style="list-style-type: none"> • Isolate valve from rest of system • If a union is in-line take it loose using pipe wrenches • Determine if there is an in-line union • Unscrew nipple from valve • Unscrew bad valve from opposite side of valve • Screw valve onto pipe, use pipe wrench to tighten • Apply Teflon tape or pipe dope to threads of pipe • Screw valve onto pipe, use pipe wrench to tighten • Apply Teflon tape or pipe dope to the threads of the opposite end of nipple that has the union on it • Screw nipple into valve and tighten with a pipe wrench • Connect union and tighten using a pipe wrench • Turn water supply back on and check for leaks 		
4. Did the trainee complete all the questions in QTP? <ul style="list-style-type: none"> • Score 80% or higher. • Did trainer review and explained all missed questions. 		

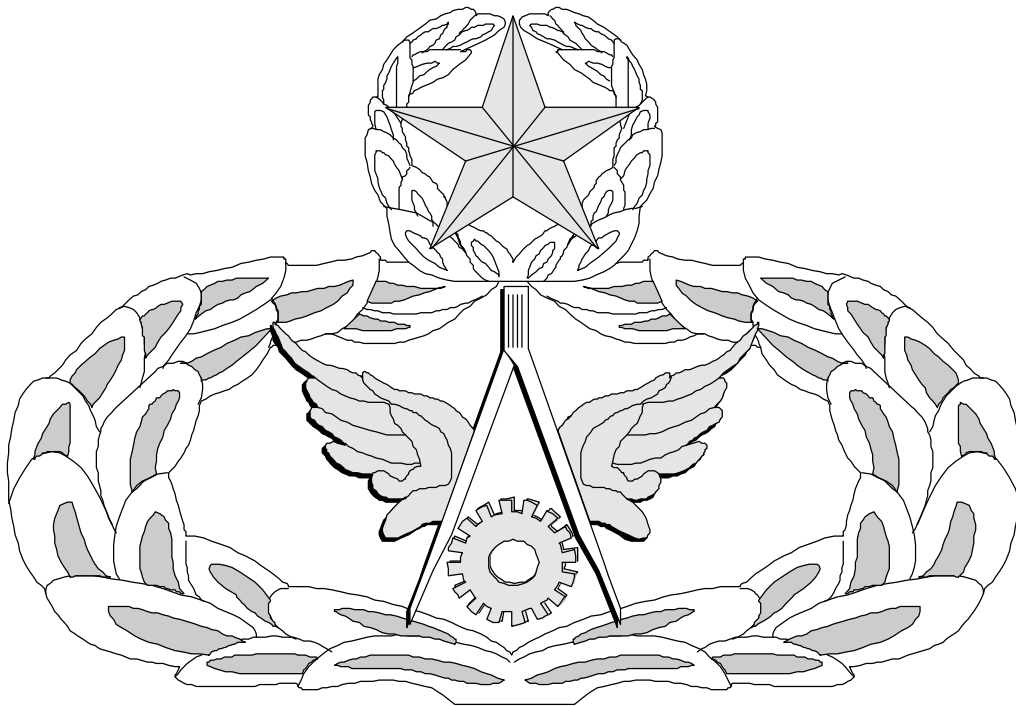
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Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



For
UTILITIES SYSTEMS

(3E4X1)

MODULE 23

VALVES

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Kev-1

INSTALL VALVE BOXES

(3E4X1-23.2.)

Question	Answer
1. The valve box should sit on top of the valve.	b. False
2. Why are valve boxes important?	c. To allow access to operation
3. How should the base of the valve box be supported?	a. On a solid base of compacted soil
4. The top of the valve box should be ½” below ground level.	b. False

PRESSURE RELIEF

(3E4X1-23.4.1)

Question	Answer
1. Where is a pressure relief valve most commonly used?	a. On hot water tanks
2. What is a pressure relief valve designed to do?	b. Keeps tanks from rupturing
3. Where must the drain be piped to?	c. the outside
4. If the valve is located on top of the water tank how many gallons should you drain from tank?	a. One gallon
5. Why should you never jerk on the valve when unscrewing it from the tank?	c. The tank may be damaged
6. What is the maximum height of a drain?	b. 2 feet

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CHECK

(3E4X1-23.4.3.)

Question	Answer
1. What is the purpose of a check valve?	d. Allows flow of liquids in one direction only.
2. What tool do you use to remove the cap?	a. Smooth-jaw wrench
3. Why should you never use a pipe wrench when removing the cap?	b. You may damage the valve
4. If the seat is worn and cannot be removed what should you do?	a. Reface it using emery cloth

GLOBE

(3E4X1-23.4.4.)

Question	Answer
1. What benefit does a globe valve have over a gate valve?	a. Can be used to regulate or throttle flow
2. What kind of tool is used to remove the bonnet of a globe valve?	c. Smooth-jaw wrench
3. What is used to re-surface the disc and seat?	d. Grinding compound
4. What may happen if you use an excessive amount of emery-based compound to resurface disc and seat?	b. You may remove too much material
5. If the seat cannot be repaired what corrective action should be taken?	b. Replace the entire valve

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GATE

(3E4X1-23.4.5.)

Question	Answer
1. What are gate valves primarily used for?	b. Start/stop service
2. What two kinds of gate valves do we use on many Air Force installations?	c. Rising and non-rising stems
3. Where are rising stems commonly found?	c. Valve pits and pump houses
4. How often should you perform preventive maintenance?	b. Semi-annually
5. What do you apply to the surface of the disc when checking for contact with the seat?	d. Prussian Blue
6. Why must you raise the disc before tightening the bonnet to the valve body?	a. To ensure proper seating of the bonnet

BALL

(3E4X1-23.4.6.)

Question	Answer
1. What does the ball in a ball valve seal against to prevent the flow of liquid?	b. Two seat rings
2. The method of replacement is determined by the existence of an in-line union.	a. True
3. What should you apply to the threads of the pipe when replacing a ball valve?	c. Teflon tape, or pipe dope
4. If you have to cut the pipe to replace a valve, what should you install with new valve?	c. A union

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